

# On the effects of education

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## On the Effects of Education

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With 1 Figure

Sociological and economic research has demonstrated consistent and strong relations between education and labour market outcomes (e.g. SHAVIT and MÜLLER 1998, HECKMAN et al. 2006), but also with outcomes in other domains, such as: Health (BOUND et al. 1995, GROSSMAN and KAESTNER 1997), crime (GOTTFREDSON 1985, LOCHMER and MORETTI 2001), political participation (HELLIWELL and PUTNAM 1999, SCHULLER and DESJARDINS 2007) and family formation (MARE 1991, KALMUN 2006).

Despite the overwhelming evidence of the relation between education and training and these outcomes, the processes that underlie these effects are still not well understood. Moreover, as most of these analyses rely on non-experimental data, we are often not even sure that education and training actually cause these effects. In that respect, it may be a little premature to talk about how education and training lead to certain positive outcomes (such as high earnings, civic engagement or good health) or prevent negative outcomes (such as unemployment or social exclusion). In this paper we will concentrate on the following questions: What are the key skills for successful functioning? How do these key skills develop over a person's life? What factors determine the acquisition and decline of skills and what is the role of education and training in this respect? How do education, training and skills affect outcomes in various domains of a person's life? What are the methodological problems in identifying the underlying causal mechanisms?

There is no pre-existing single framework that can accommodate all these issues, although much work has been developed in several sub-areas. In section 1 we will draw on the literature of key competences to identify what skills are relevant for having good outcomes in the different domains of the life course. In section 2 we will explore how these key skills develop over the life time. We will draw upon insights from cognitive psychology and neuropsychological theory about how people learn, about how brains function and about how learning is affected by biological factors such as age and health.

Section 3 will enlarge more on the determinants of skills acquisition. People gain skills through initial education, training, and informal learning (e.g. in work or in daily life). Economic and sociological theories tell us why people invest in education and training and what the barriers for investing are. Educational and psychological theories seek to establish which modes of learning and instruction are most effective.

People do not only acquire skills, they lose skills throughout their lives as well. In fact, one of the major challenges of the OECD economies, especially in ageing societies, is that these skill losses among older cohorts might outweigh the skill gains through investments in education and training of younger cohorts (for an empirical illustration, see WILLMS et al. 2006). It is therefore vital to explore whether education and training are similarly effective

in preventing skills losses as they are in producing skills gains, and to identify measures that can be taken to slow down or prevent the process of skill decline. Section 4 will elaborate on this further.

Investment in skills acquisition and prevention of skills decline is relevant because skills affect a large range of outcomes in people's lives, from economic and social outcomes to outcomes on health and crime. This is elaborated in Section 5. In Section 6, we will pay attention to the methodological and statistical problems involved in measuring the effects of education and training. Section 7 concludes with some recommendation how to proceed.

## 1. What Are Key Skills?

### 1.1 *The Quest for Key Skills*

The last few decades have seen an increased awareness of human capital as one of the driving forces of economic development. Policy makers have realized the importance of investing in education and training as a way of improving the existing stock of skills. This has resulted in an accompanying need to monitor and assess the stock of human capital. What soon became clear is that education, as such, is a poor indicator of the stock of human capital. Individuals with the same nominal level and type of education can differ markedly in their command of various skills. Likewise countries that have more or less comparable levels of educational attainment can nevertheless differ substantially in the level of skills that are acquired in education. This is one of the reasons why organisations such as IEA and OECD took the initiative to start studies like Third International Mathematics and Science Study (TIMSS), Programme für International Student Assessment (PISA), International Adult Literacy Survey (IALS) and Adult Literacy and Lifeskills Survey (ALL) to assess the actual skills levels of students and adults.

As the emphasis shifts from educational qualifications towards skill measurement, the question naturally arises as to what skills should be measured. It seems clear that in order to perform even the most basic tasks many discrete skills are required. Determining which skills should be measured is a complex and difficult task, which is compounded by the fact that people not only make use of generic skills such as the ability to communicate or the ability to learn, but also of a large number of highly specific skills pertaining to particular tasks, situations and objects.

In order to introduce some order to understanding the diversity of human skills, many scholars have engaged in a quest for so-called core skills or key competencies. The term *Schlüsselqualifikation* was first introduced by MERTENS (1974) to denote those skills that have a more permanent value in a time where specific skills may quickly be rendered obsolete and where workers need to be more flexible (for a description of the history of the concept of key qualifications, see NUHOF 1998). Although this conceptualisation obviously does not in itself alter the complexity of the full range of human skills – which after all exists in the real world – it can to some extent be seen as a way of establishing priorities as to which particular skills should be measured. That said, like the quest for the Holy Grail, the quest for key competences has proved to be a difficult undertaking. Numerous lists can be found in the literature that purport to more or less sum up the most important skills. Although most of these lists have much in common, they usually lack thorough theoretical foundations. A welcome contribution in this

respect has been made by the DeSeCo (Definition and Selection of Competencies) project (see also H. GILOMEN in this volume). This project was initiated by the OECD to provide an overarching framework to international skills assessments, and the main results are contained in the report “Key Competencies for a Successful Life and a Well-functioning Society” (RYCHEN and SALGANIK 2003a). Emphasising the need for competence assessment rather than a narrow focus on skills, competencies are defined in this project as: “the ability to successfully meet complex demands in a particular context through the mobilization of psychosocial prerequisites (including both cognitive and non-cognitive aspects)” (RYCHEN and SALGANIK 2003b, p. 43). The basic difference with the earlier concepts of skills (however poorly they have been defined) is the holistic nature of the concept of competence. It refers not only to a range of cognitive and non-cognitive skills and other prerequisites that need to be in place in order to perform in a competent way, but it also refers to the notion of ‘orchestration’, the ability to use these constituent elements in a meaningful and deliberately arranged way. In that regard, the ‘whole’ that makes up a competence is more than just the ‘sum of its parts’. Skills can therefore best be considered as one of the constituent elements of a competence.

Based on theoretical reviews, consultations with experts as well as the identifications of important policy goals, the project identifies three categories of key competencies (see ARTELT, GILOMEN, this volume) that require a reflective approach and critical stance (including meta-cognitive skills, see RYCHEN 2003).

Although the theoretical framework provided by the DeSeCo project injects some welcome theoretical rigour into the discussion of skills measurement, it does not in itself directly give rise to clear recommendations as to the competencies to be measured. The best way to conceive of this overarching framework is that it indicates the main underlying competencies that render skills their significance.

There are other approaches that provide some more detailed indications of the skills that are relevant for well-functioning. An interesting approach is the one from BINKLEY et al. (2003). They developed a framework that concentrated on two strands of research: research on what skills are necessary in the workplace, and research on cognitive functioning. From the first strand a list of six skill areas was extracted that seemed to underlie many of the most important skills: Communication (speaking, listening, reading, and writing), Mathematical, Problem Solving, Intrapersonal (motivation, meta-cognition), Interpersonal (teamwork, leadership) and Technology. From the strand of psychological theory four core domains of intelligence were extracted: practical abilities (the ability to practice, use and implement knowledge and skills), crystallized analytical abilities (the ability to use learned skills and have access to existing knowledge), fluid analytical abilities (the ability to process novel information) and creative abilities (the ability to create, invent, discover, imagine and hypothesize). The two strands can be seen as two dimensions, where the skills areas of the workplace approach constitute the context areas in which the four types of intelligence take place. The two dimensions make up a matrix with  $6 \times 4 = 24$  cells. Each of these cells specifies key skills related to a specific skills area (e.g. applying math to everyday situations is a practical ability in the skills area of Mathematical, while solving an equation is a fluid ability in this area).

### *1.2 The Importance of Non-Cognitive Skills*

A narrow definition of human capital that only considers differences in schooling outcomes, test scores and training severely limits our ability to understand the sources of heterogene-

ity in socioeconomic success. For instance, it is intuitively obvious that non-cognitive traits such as ambition, persistence, conscientiousness, charisma, and the like are also important for success in life and for the development of skills. EDISON's remark that "genius is 1 % inspiration and 99 % perspiration" underscores the importance of persistence and motivation in creative pursuits. The increasing importance of social skills is illustrated by the trend towards more teamwork in professional life in a broad range of jobs, industries and occupations.

A broader perspective, which incorporates findings from psychology, as well as knowledge of biological and medical sciences, in the analysis of skill development over the life-cycle, also highlights important interdependencies between cognitive and non-cognitive skills in skill formation. For example, recent research on the economics of human skill formation has demonstrated the importance of factors besides intelligence in creating productive persons (e. g. HECKMAN and MASTEROV 2007). Investment in education and skill acquisition is powerfully influenced by personality traits and preferences, such as attitudes towards risk, time preference (i. e. a willingness to forgo current utility or well-being in order to have a greater return in the future) or preferences for work and leisure. Moreover, such traits and attitudes also affect other outcomes such as health. For example, time preference is related both to investment in education as well as investment in healthy behaviour. Not taking into account such an attitude would lead to a misspecification of the relation between skills and health outcomes and a misunderstanding of how individual differences and changes in cognitive and non-cognitive skills translate into inequality, life-cycle mobility profiles, and heterogeneous social and economic outcomes.

### 1.3 The Importance of Professional Expertise

Despite the fact that employers often list generic cognitive and non-cognitive skills as the most important skills required in the workplace, professional expertise is a condition *sine qua non* for success in many occupations. For example, nobody would doubt that in order to become a good medical doctor, architect or car mechanic, one needs to acquire the domain-specific knowledge and skills that make up the professional domains of these occupations.

There is a broader issue here. The last decades have seen a growing consensus among cognitive psychologists and educationalists that context plays an important role in the processing of new information. The human brain is not a "tabula rasa" in which new information can be stored in every possible way (SCHMIDT 1997). Rather, new information acquires meaning when it is incorporated into a mental framework, where it can be related to earlier information. Both storage and retrieval of information is context-bound. That means that contexts such as those provided by the profile of a discipline or an occupation can provide powerful learning environments (DE CORTE 1990).

Some researchers even doubt whether truly generic competences exist, and argue that even generic competences (like analytical thinking or communication skills) are context-bound (PERKINS and SALOMON 1989). One may doubt whether this is true in the extreme, but such authors do have a point when they claim that generic competences have little value in the absence of specific competences. The German psychologist WEINERT formulated this as follows: "Over the last decades, the cognitive sciences have convincingly demonstrated that context-specific skills and knowledge play a crucial role in solving difficult tasks. Gener-

ally, key competencies cannot adequately compensate for a lack of content-specific competencies.” (WEINERT 2001, p. 53.)

The importance of specific competences can also be illustrated by looking at how generic and specific competences are developed. It is usually conjectured that young people first develop generic competences as basis for the subsequent development of specific competences. This is certainly true for the so-called basic skills or foundation skills, like reading, writing and math. These basic skills need to be in place before occupation-specific skills can be developed. However, for higher-order generic skills like analytical thinking, learning to learn, diagnostic abilities and problem solving, the reverse seems to be true. Research on the development of expertise has shown that developing specific competences while studying in a specific discipline such as economics, engineering or biology also triggers the development of general academic competences like analytical thinking, problem solving etc. It has proven extremely difficult to develop these generic competences in a separate module without any relation to a specific framework such as a discipline or occupation. There are some examples (e.g. HALPERN 1998) that claim to do so, but the effectiveness of these programs is scientifically disputed (WEINERT 2001).

## **2. Skills Development over the Life Span**

From a cognitive and neuropsychological perspective, higher order brain functions follow a steep developmental pattern and reach a plateau of optimal function in young adulthood (see also HASSELHORN et al., this volume). Such processes and changes therein can be measured on a behavioural level using dedicated neurocognitive instruments which tap the efficiency within specific neuropsychological domains, such as language, intelligence, memory, attention and speed of information processing.

Optimal neurocognitive development is dependent on a complex interplay of factors, with genetics, socio-economical status, educational achievement, adequate nutrition and uncompromised mental and physical health being the strongest predictors of developmental success. Researchers have coined the term ‘brain reserve capacity’ (or BRC) to indicate the neurobiological constraints which determine maximum processing capacity of higher order brain functions. This concept has proven its validity in, for example, predicting individual cognitive ageing trajectories later in life. Important proxy measures of BRC include educational level and occupational achievement.

Large individual differences exist in the offset and rate of decline of specific cognitive functions. On a population level, a number of cognitive abilities such as memory function, information processing speed and attentional capacity tend to decline with advancing age (cf. for extensive coverage HASSELHORN et al., VOELCKER-REHAGE, FALKENBURGER, this volume).

Still, cognitive ageing is not merely a predestined process which ultimately leads to pathological states, such as a cognitive disorder like dementia. The ability to learn new skills is still present in older individuals, but – on average – more time is needed to develop the same level of mastery as for younger persons. Recent advances in cognitive neuroscience have convincingly demonstrated that healthy brains show considerable capacity to compensate for reduced integrity of functional networks or to reorganize existing networks to adapt to changing task demands. The importance of adequate and continued exposure

to environmental stimuli during the life course is now considered pivotal for optimal conservation of cognitive abilities in old age (conceptualised in the 'use it or lose it' paradigm).

Empirical findings suggest that complex intellectual activity increases cognition of older workers (SCHOOLER et al. 1999). Skill investments made during working life might improve people's capacity to continue learning and adapting to new environments. Other factors that are conjectured to affect the development of cognitive ability at later stages in life include occupation, leisure activities, lifestyle, and social interaction.

### **3. Determinants of Skills Acquisition**

#### *3.1 Education as an Investment*

In economics, education and learning is treated as an investment. In this view people are expected to invest in education and learning when the costs are smaller than the expected future benefits. Both the costs and the benefits of education can be interpreted broadly. People differ in the degree in which they enjoy education or learning and in the degree to which they value the potential benefits of education. Due to heterogeneity in preferences there will also be heterogeneity in the decision to learn. BORGHANS et al. (2007) provide a model for investments in education and learning that capture a wide range of potential differences between individuals. In the first place people differ in their ability to acquire skills. The costs of education are lower for people who acquire skills more easily since they learn faster. The ability to learn depends both on cognitive and non-cognitive skills, e. g. someone who is easily distracted from a task will need more time to learn. Secondly, people differ in preferences. They might differ in how they value learning, working and leisure. They might differ in how much they value a high income or other potential benefits of education and they might differ in how they value future benefits compared to current benefits (time preference, the discount rate) and how they account for risks in outcomes (risk aversion). Third, people might face constraints in their choices. Credit constraints can influence the decision to attend school, but also a lack of facilities for education and less favourable family conditions can be treated as such constraints. Finally, the decision to invest in education will depend on information available at the time of investment. If people don't know about the benefits of education it is unlikely that they will invest.

#### *3.2 Social Inequality in Access to Education and Training*

Sociologists have a long tradition of research looking at the social barriers to education and training. While gender inequality in initial education has vanished and actually turned into an advantage for girls in many western countries, gender inequalities still persist in occupational careers and later access to training. Social inequality related to the family background both in terms of socio-economic status and ethnic status is more persistent. Part of these differences relate to differences in school performance and learning abilities, the so-called primary effects of social stratification (BOUDON 1974). These may be caused both by differences in innate abilities as well as differences in socialization processes. The cultural capital of the family (BOURDIEU 1984) in particular provides a powerful predictor of the school performance. But even with the same school performance, students from different

family backgrounds make systematically different choices in education (the secondary effects of social stratification) and given the number of choices that have to be made during the educational career, the cumulative effect of these choices may even overwhelm the primary effects. These differences in choices relate to differences in social cost-benefit analyses: the social costs and benefits involved in obtaining education are different for students from different social backgrounds. Following an educational career that is different from the one that is common in the family induces social costs, while the social benefits may be lower.

### 3.3 *Effective Learning and Instruction*

Following a certain type of education or training path does not automatically imply that all students are likely to acquire the same set of skills. Educational research has shown that there is considerable variation between educational systems, between schools, between study programs and between teachers in how much skills students acquire during education or training. Recent research suggests that there is a strong relation between the development of competencies and particular characteristics of the learning environment (VAATSTRA and DE VRIES 2004). It would go too far to fully discuss all educational theories on instruction and learning outcomes, but we can note a number of recent developments:

- *Situated learning theories* (CTGV 1990, GLASER 1991) emphasize that competencies and competence development are context-specific. They stress the importance of coherence and context-relevance (e.g. real life experiments, simulation, practical work experience) in the design of the curricula in order to develop professional expertise.
- *Self regulated learning theories* point to the relevance of meta-cognitive abilities and information processing strategies of students (KOLB 1984, VERMUNT 1992). Learning styles differ between students ranging from a memorising and rather atomistic way of learning towards a more constructivist approach in which concepts and theories are actively incorporated in a coherent body of knowledge. An interesting finding in this respect is that the way examinations are organised may foster a different learning style than the curriculum actually intended (SEMEIJN and VAN DER VELDEN 2002): e.g. multiple choice exams foster different competencies than the writing of essays, although the actual curriculum may be quite the same.
- *Active learning theories* reject the traditional naïve model of the teacher as the expert, filling so to say the brains of the students with his knowledge. ‘Powerful learning environments’ (DE CORTE 1990) and active instructional methods like problem-based learning and project-oriented education are thought to foster the development of generic competencies like problem solving and meta-cognitive abilities.

In addition to these innovative ways of learning based on elaborate theories on how individuals actually learn, educational research has traditionally stressed ‘time on task’ as one of the most important factors affecting student outcomes. That is the actual time students spent on education (within the class-room and through self-study) is a good predictor of the learning outcomes net of other characteristics such as intelligence.



### 3.4 Training and Informal Learning

People not only learn during initial education, but later in life as well. In the human capital literature, many studies have analyzed the effects of workplace training participation on workers' wages (for a recent overview, see BASSANINI et al. 2005). Several studies have found high returns on workers' participation in training. BRUNELLO (2004) found that having recently attended training increases a worker's income by about 12%.

However, one may wonder whether it is really the participation in formal training that makes the difference. BORGHANS et al. (2006) show that employees spend much more time on informal learning activities than on formal learning. They also found that when employers stimulate workers' participation in formal courses, these workers will also spend more time on informal learning in the workplace. As many of the studies on the effect of formal training do not measure the time spent on informal learning, all the benefits of the knowledge and skill acquisition of the workers are attributed to their participation in formal training.

ARROW (1962) emphasized the importance of unstructured workplace learning, not from the perspective of the individual worker, but rather from the perspective of the firm. He found that informal learning is a more or less automatic by-product of the regular production process of a firm, which he labelled 'learning by doing'. From a similar firm perspective, in the 1990s researchers became more interested in the effects of the organization of the production process. The shifts in the skills demanded in many jobs were found to be related to the organizational changes that accompany the diffusion of ICT: flat hierarchies, autonomous work groups and teamwork. These transformations of workplaces induced a growing demand for workers with both cognitive skills and 'people skills'. In particular, the notion of 'Innovative Work Practices' in the so-called 'High Performance Workplace (HPW),' originally developed in the discipline of Human Resource Management, has been used to explain the improved performance of a firm. Obviously, workplace learning is at the heart of the HPW. Although the HPW is usually not clearly defined, many authors include (i) delegation of responsibility to autonomous teams, (ii) job rotation, (iii) performance-related earnings and (iv) training to support organizational change.

## 4. Determinants of Skills Obsolescence

Until now, only scattered studies on different aspects of skills obsolescence have been published. Most of these studies were published in periods in which unemployment was high. This increased the focus on the adverse impact of skills obsolescence for the workers involved. It is interesting that in the recent policy debates on skills obsolescence and 'lifelong learning' the main focus is on the waste of valuable human resources and on the non-optimal performance of workers with inadequate skills. This brings skills obsolescence to the heart of the economic challenge the western economies face: in realising the transformation towards a knowledge-based society with an ageing population.

#### *4.1 Typology of Causes of Skills Obsolescence*

DE GRIP and VAN LOO (2002) developed a typology of different types of skills obsolescence, based on the cause of the obsolescence. Firstly, the depreciation of human capital may simply be caused by the wear of skills, resulting from the natural ageing process. Physically or mentally challenging working conditions may accelerate the wear of a worker's skills. Large epidemiological studies have shown that health-related factors are involved in the enhanced cognitive decline seen with increasing age. In addition, several chronic diseases have been associated with a reduced cognitive capacity in both epidemiological surveys and clinical case-controlled studies.

The second category of technical skills obsolescence concerns the atrophy of skills due to the lack or insufficient use of skills. This atrophy could result from unemployment and career interruptions, or from employees' working below their attained level of education. ARTHUR et al. (1998) conclude, on the basis of a meta-analysis from the psychological literature on skill decay and retention, that there is substantial skills obsolescence when skills are not practiced or used. DE GRIP et al. (2008) show that job-worker mismatches induce cognitive decline with respect to immediate and delayed recall abilities, cognitive flexibility and verbal fluency. Also, as a result of specialization certain knowledge and skills acquired during initial education may get lost. Apart from these two factors related to the personal characteristics of the worker, skills obsolescence may also occur as a result of changes in the demand for skills, due to e.g. technological or organizational developments in the production process.

#### *4.2 "Use it or lose it"*

Although it is extremely important to better understand how to arrest the process of cognitive decline and to ascertain whether there is scope and need for policy intervention, the study of the determinants of cognitive decline is still in its infancy. Neuropsychological research has shown that the decline in cognitive abilities is strongly related to the extent to which people are exposed to situations in which they can still use their cognitive abilities: the so-called "use it or lose it" paradigm (vgl. VOELCKER-REHAGE; FALKENBURGER, this volume). An interesting illustration of this idea is provided by a cross-national comparison of the cognitive performance of the elderly and labour force participation rates. Using data from the Survey on Health, Ageing and Retirement on cognitive skills of the population aged 50 and above, ADAM et al. (2007) show that relative cognitive skills of workers aged 60–64 are on average higher in countries in which – as a consequence of national institutions – relative participation rates of older workers are also higher (see Fig. 1).

It is not employment as such that prevents cognitive decline; the key factor is being involved in work that is intellectually stimulating. The work of SCHOOLER et al. (1999) that was cited above indicates that complex intellectual activity increases cognition of older workers. Similarly, BORGHANS et al. (2006) show that being involved in work from which you can still learn has a preventive effect on cognitive decline. Young workers, by virtue of the fact that they are still considered to be novices in their field of expertise, show the steepest increase of knowledge and skills. For older workers the pattern is more varied. In their case, learning only occurs when they are exposed to new tasks. Being involved in routine work does not prevent cognitive decline.

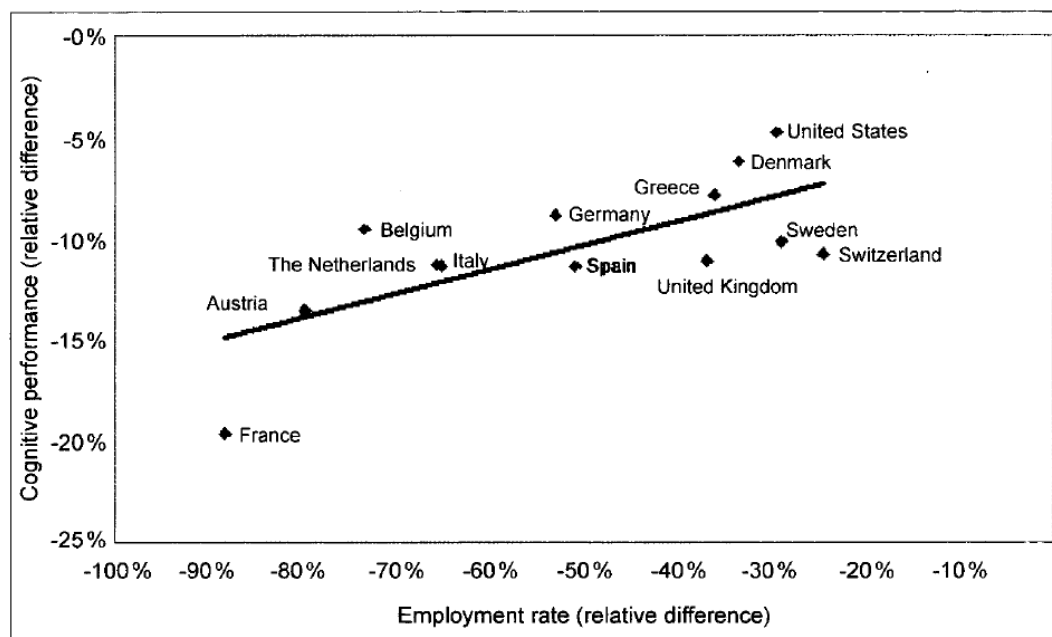


Fig. 1 Employment rate and cognitive performance: Relative difference between 60–64 and 50–54 years old men. (Source: ADAM et al. 2007)

## 5. Education, Skills and Outcomes

### 5.1 Education, Skills and Labour Market Outcomes

Cognitive skills are a key determinant of an individual's productivity, and therefore it is not surprising that cognitive skills are related to economic success. There is a large body of evidence showing that higher cognitive ability is associated with better labour market outcomes (e. g. HECKMAN et al. 2006). These labour market outcomes include wages, job stability and employment opportunity, occupational status, job satisfaction, career potential, and the quality of the match between competencies and skill requirements.

One of the interesting questions in this respect is to what extent these skills have been produced in education: is there any causal effect of education? There are rivaling hypotheses on the role of education. Very often the strong relation between education and labour market outcomes is explained in terms of human capital theory (BECKER 1964), which claims that people with more years of schooling earn more because the competencies they acquired in education have made them more productive. While this is probably true to some extent, at least in the aggregate, it tells only part of the story. Scholars such as SPENCE (1973) and ARROW (1973) have pointed out that the selection, allocation and rewarding of individual employees take place on the basis of signals such as formal qualifications as well as on the basis of productivity. This is usually explained in terms of incomplete information and bounded rationality. The signals form a solution to this problem, as they are assumed to indicate the average productive capacities of the group to which they refer. The labour queue theory (THUROW 1975) adds an interesting twist, pointing out that many relevant competen-

cies are not even learned in education, but are picked up through work experience on the job. According to this theory, education is an indicator of low training costs rather than of high productivity. Finally, some scholars have questioned whether education has any effect at all on graduates' ability to perform, pointing out that this relationship is in fact weaker than that between education and reward (BILLS 2003). This has led credentialists such as COLLINS (1979) to claim that higher education does not lead to superior competencies, but is used by 'gatekeepers' to legitimize the rationing of access to high-status, highly paid jobs.

In reality, there is probably an element of truth in all these theories. The crucial point then comes down to specifying the contexts under which one or the other mechanism prevails. The mechanisms are likely to differ according to the kind of job or position, labour market segment (private/public, economic sector), and country. There are several characteristics of education that are thought to be relevant. For example, the reliability of the selection process is a factor that determines the trustworthiness of signals (VAN DER VELDEN 2003). Similarly, a high degree of stratification of higher education (division into distinct levels or tracks: ALLMENDINGER 1989) leads to a more homogeneous output per stratum, which further increases the reliability of the signals. The standardisation (ALLMENDINGER 1989) of curricula and examinations may also be important, since nationally recognised diplomas will be better known to employers, and therefore easier to use as criteria in selecting and rewarding personnel, than qualifications that differ in content from institute to institute. There is strong evidence that in countries characterized by a high degree of selectivity, stratification and standardization, employers are more likely to select and reward employees on the basis of formal educational qualifications than in countries where education is less regulated (MÜLLER and SHAVIT 1998).

## *5.2 Education, Skills and Social Outcomes*

There is good empirical evidence that education not only affects labour market outcomes, but is a strong predictor of outcomes in other life domains as well, such as family formation, health behaviour, crime, civic engagement, political participation etc. (PALLAS 2000). Education not only affects the individual outcomes in these domains, but also affects the social returns as a result of spill-over effects. The effects of education have been studied both at the level of individual outcomes (individual returns) and at the level of societal outcomes (social returns). The social returns are usually larger than the sum of the individual returns because higher educated people also affect others (making them more productive for example or having an effect on technological innovation). Moreover there are important spill-over effects to other domains like health, social cohesion etc.

This is one of the reasons why policy makers are so interested in understanding these broader effects of education because the social returns in terms of decreased costs for health and crime may well overwhelm the individual economic returns. The OECD recently published a report on the social outcomes of learning (SCHULLER and DESJARDIN 2007), underpinning this need for investment in education to increase health and civic and social engagement.

Just to give an impression, we provide some estimates of the effects of education based on an analysis of Dutch data by GROOT and MAASSEN VAN DEN BRINK (2003a,b). On the individual level, one additional year of schooling leads to:

- a wage increase of 6–8 %;
- an increase in health by around 0.5 %;
- a decrease in several forms of crime by around 0.2 %;
- a decrease of reliance on social security by around 0.3 %.

At the aggregate level of a society, increasing the average level of education by one year leads to:

- an increase in economic growth of between 0.5 and 1 %;
- a reduction in health care costs by 5 %;
- a reduction in costs of crime by around 7 %;
- a reduction in costs of social security by 2 %.

As with the effects of education on labour market outcomes, the effects of education on social outcomes are still not completely understood. Broadly speaking, two mechanisms can be distinguished: an effect on skills and an effect on allocation. For the first effect we assume that education directly affects knowledge and skills that are relevant for healthy behaviour, civic engagement etc. For instance health programs may increase the knowledge of students in this area, leading to healthier behaviour. The second mechanism refers to the role of education in allocating students to particular jobs or roles in society, e.g. higher education increases the chance of ending up in healthier jobs or in social networks in which civic engagement is higher. In that case the role of education is more indirect, and it is not certain that investing in education will always have the anticipated effect.

### *5.3 Relative or Absolute Outcomes?*

The question of whether investments in education will lead to certain outcomes at a societal level is dependent on whether these outcomes are scarce resources or not. If people have to compete for scarce outcomes, investment in education will change the relative distribution, while leaving the absolute distribution unchanged. To take an example: suppose that the economy can support only a fixed number of management jobs and that the entrance to management jobs is based on educational attainment. In that case, investing in education will affect an individual's chance to enter a management position, but it has no social effect because the distribution of management jobs is not affected. Increasing the average level of education in society will only lead to better outcomes in an absolute sense if the investments in education increases the number of management jobs the economy's is able to support (e.g. by raising the overall level of productivity). If this is not the case, such investments will lead to diploma inflation, as a higher level of education will now be needed on average to get the same management job.

## **6. The Methodological Problems in Identifying the Effects of Education and Training**

In the last section we already identified two problems associated with assessing the effects of education and training. The first problem relates to the mechanism through which educa-

tion and training affect outcomes: are the effects due to imparting relevant skills or does following education and training merely affect the allocation to position or roles in societies that are associated with favourable outcomes. The second problem addresses whether education and training has a relative effect or an absolute effect on achieving these outcomes. If the desired outcomes are scarce, education and training will only affect the relative position of people: the result effect is in that case an individual effect but not a social effect.

Apart from these two problems, there are two additional statistical problems that arise from the fact that most research on the effect of education and training is based on cross-sectional or longitudinal survey data, while experimental research is usually limited to very specific groups. These problems relate to unobserved heterogeneity and endogeneity.

The problem of unobserved heterogeneity occurs when there is some other variable which affects both the decision of an individual to invest in education or training (the variable of interest) as well as the outcomes of these investments (the dependent variable). For example, the effect of education on health may well be caused by the fact that both are related to certain personal characteristics such as time-preference (that is the willingness to give up immediate consumption for larger future benefits) that affect both the investment in education and the investment in healthy behaviour. When this variable is not controlled for in the analysis (unobserved heterogeneity), the parameter estimates of the other variables in the model may be biased: the so-called omitted variable bias. This may lead to a serious over- or underestimation of the effects of education and training. Controlling for relevant covariates may reduce the problem, but will never eliminate it entirely, as there will always be variables that have not been measured and are thus not controlled for (hence unobserved heterogeneity). The same principal problem remains in the case of propensity score matching, a technique designed to create a counterfactual group (control group), based on observed predictors of group membership (treatment group, control group).

Another problem occurs when the direction of causality is not clear (the problem of endogeneity). In estimating the effect of training on, say, earnings, we assume that training is exogenous to (that is: not in itself affected by) earnings. However, people may follow training because they were promoted to a better job, rather than having been promoted as a result of their investment in training. In that case the causal link between training and wages is reversed.

The best way to address these problems would be with an experimental design in which some people are randomly assigned to an education or training treatment and others to a control group, so that the outcomes for both groups can be compared. In the case of education, it may be quite difficult to realise a full experimental design: no society would allow students to be placed in a control group in which they receive no education. Even in the case of training, setting up an experimental design is not easy to realise, as people who really want (or as the case may be: don't want) to participate in training will find ways to circumvent the control group (or experimental group). Even if such a design can be realised, the conditions for a classic double-blind experiment are unlikely to be met, as both teacher and students know which group they belong to. This may affect outcomes, regardless of what the treatment actually consists of. This effect known in medical studies as the placebo effect, has often been observed in psychological research.

In the absence of a classic experimental design, researchers have turned to so-called 'natural experiments'. These often involve changes in policy, which allow a group whose

access to organized learning was previously restricted to enter or increase their participation in education or training. Examples are changes in the legal minimum school-leaving age, changes in the minimum number of school hours per week, etc. By comparing groups that entered education just before the policy was introduced with groups that entered just after the policy was introduced, one can study the effects of these changes. The problem with these natural experiments is that the observed effects are limited to the group that is potentially affected by this measure. This is also known as the Local Average Treatment Effect (LATE). In the case of e.g. increasing the minimum school-leaving from 15 to 16 years, the group that will be affected by such a measure is the group that would prefer to leave education at the age of 15 or earlier. Students who have no intention of leaving education before the age of 16 are not affected by this policy.

Variables thrown up by 'natural experiments' can be thought of as a subset of a broader approach designed to address the problem of unobserved heterogeneity and endogeneity: the Instrumental Variable approach. The basic idea is to find a truly exogenous observable variable that is related to the variable of interest (i.e. education or training), but unrelated to the outcomes or the unobserved explanatory variables (such as abilities). In the case of the example above, the policy measure of increasing the minimum school-leaving age is related to the variable of interest (education), but in itself unrelated to outcomes or other explanatory variables (as the measure affects all people, regardless of their other characteristics). This exogenous variable can be used to "instrument" the variable of interest (i.e. education).

In practice, this is easier said than done, because a good Instrumental Variable must be truly exogenous with respect to other unobservable variables, and it must have a strong effect on the variable of interest (education or training). Moreover, the above-mentioned problem of LATE should not apply, so that the Instrumental Variable affects the variable of interest for the whole population and not just for a subgroup of subjects. Many Instrumental Variables fail these assumptions. Moreover, empirical results using Instrumental Variables do not always show plausible results. Particularly in the case of education, many findings using Instrumental Variables result in stronger rather than weaker effects of education. While this may be to some extent reassuring for policy-makers (the message being that we are presumably not seriously overestimating the effect of education), it does not fit well with the common sense expectation that unobserved characteristics should affect both educational success and outcomes in the same general way. It is very hard to conceive of any personal characteristic that has a negative effect on investments in education, but a positive effect on outcomes like labour market success, health, civic engagement etc.

A second way of dealing with unobserved heterogeneity and endogeneity is by looking at changes within persons over time. The basic idea here is to look at how changes in the variable of interest (e.g. education) affect changes in outcomes. This approach was developed in the 80's in the social sciences as the multi-level approach (with intrapersonal changes being the lowest level) and later known in the economic sciences as the differences-in-differences approach and the fixed-effects approach. The attractive feature of these models is that by shifting from a between-persons analysis to a within-persons analysis, a good control for unobserved heterogeneity is established. However, this approach also is not without its problems. Take the example of a person who follows education in period P1, then works for some time in period P2, then goes back to education for period P3 and finally starts working again in period P4. The basic idea of this approach is to relate the difference

in earnings between P4 and P2 to the number of years spent in education in P3. If we assume that the earnings of both P2 and P4 are equally affected by unobserved characteristics, the difference in earnings between the two periods would constitute the 'true' effect of the education in P3. There are basically two problems here. If we generalise the effects, we assume that the effects of the education followed in P3 is the same as the effect of the education followed in P1, which may not necessarily be the case. Actually the two forms of education may be quite distinct (e.g. the first one more generic and the second one more specific) which reduces the generalisability of the effects. The same problem also applies to interpreting both outcomes in P2 and P4. These two periods of work may be related in totally different ways to the education followed in the preceding period (e.g. the period P2 may be a short period in which the individual simply wants to some time out of education). A second problem is that of measurement error in a panel study. If we have two measures of a similar construct over time and both measures contain some measurement error, calculating change scores will produce larger measurement errors (ALLISON 1990). This will render them less useful as outcome measures.

## **7. How to Proceed?**

For evidence-based policy it is important that the estimates of the relation between education and training and outcomes are as free as possible from bias. Policy makers would be misinformed if the effects of, for example, investments in education or training were seriously overestimated (in which case some of the investment might be a waste of money) or underestimated (in which case policy makers might decide to withhold investments in education or training that would have yielded large returns in terms of skills). Moreover, policy makers need to know how education might affect these outcomes. Does education affect the skills or values of students which in turn affect the outcomes (the direct or socialisation effect)? Or does education have an effect because it allocates people to certain jobs or positions in society (the indirect or allocation effect)? Moreover, in order to estimate the effect of a policy intervention designed, for example, to increase the level of education in the population, we need to know whether the outcomes are a relative good or an absolute good.

In this paper we have analysed the effects of education and training on outcomes, like economic outcomes (e.g. earnings, unemployment and job insecurity) and outcomes in other domains (e.g. health, crime and political participation). We have also indicated that little is understood of the underlying process and that there are a number of problems that withhold us from drawing firm conclusions about the causality of the effects of education and training as well as the extent to which these effects apply only to individuals or also hold in the aggregate.

Although a number of tools have been developed to deal with the statistical problems, this does not completely solve the problems, and the effects of education that are observed are really just 'best guesses' with no complete certainty about the causality of the relations. Even where researchers have concentrated on experimental data, these experiments are usually small-scale or natural experiments (e.g. resulting from policy interventions) that cannot simply be extrapolated to the effects of education and training in the population as a whole.



This does not imply that we should not continue to use these models in our search for good estimates of the effects of education and training. On the contrary, the growing consensus among social scientists is that we should take the problems of unobserved heterogeneity and endogeneity more seriously. We should continue to look for experimental data that allow us to draw stronger conclusions concerning the effects of education. Although it will be hard to meet the strong requirements of a double-blind experiment, it will be possible to have more systematic variation in educational treatments and to study their effects. This will hold especially in the area of adult learning, where the interventions are usually more restricted in time and scale, and where experimental variation is easier to implement.

However, statistical tools cannot compensate for a lack of good data, and this is exactly the point we would like to make. The progress to be made in the coming years is to have better data in two areas: we need better data that can be used as control variables or Instrumental Variables and we need data on the actual skills development in education and training.

Very often, researchers have been inventive in exploring the existing data for useful control variables and Instrumental Variables, but the problem is often that not enough attention has been paid to these issues in the design of the survey. We need to improve our survey data to allow for a better identification of causal effects. That means that more attention should be paid to Instrumental Variables that help identify causal relations. But we should also work harder when designing surveys to build in good control variables. An interesting option in this respect is to link existing panel data to register data, as has been done frequently in the Scandinavian countries and more recently in the Netherlands. This approach has several advantages:

- by following up people through registers the problem of panel attrition is reduced;
- it provides good and reliable data on the timing of events (e. g. the start and ending dates of unemployment spells) and on information that is more difficult to measure in a survey (e. g. income, crime etc.);
- it provides a rich data source for contextual information such as households, neighbourhoods, periods etc. which may be used as Instrumental Variables or control variables.

Finally, we will never be able to determine the effects of education and training if we do not have adequate measures that assess the level of skills at the entry of education and training and again at the end. Good skill measures will enable us to identify the added value of education and training, in particular that part of this effect that is attributable to imparting relevant skills. Most attempts to measure skills on a large scale have deliberately focused on particular aspects of skills rather than attempting to measure the full range of skills. For example, the OECD initiated studies like PISA, IALS and ALL concentrated primarily on literacy, science and numeracy skills. Given the enormous importance of basic literacy and numeracy for a large range of challenges people are faced with in today's world, these and similar studies constitute hugely significant milestones in terms of coming to grips with the worldwide stock of human capital. That said, there are clearly other major areas of skills that merit attention. There is a clear need for a broadening of the scope of large-scale skill surveys, in order that they better reflect the range of competencies that are needed for, as DeSeCo put it, "a successful life and a well-functioning society". This may refer especially to many of the so-called 'soft skills', social and cultural competencies that are widely recognised as being very important.

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